

CLAIMS

1. A machine cycle unwrapper for use with a glass forming machine which includes a blank station for forming a parison from a gob of molten glass having at least one mechanism, a blow station for forming a parison into a bottle having at least one mechanism, a feeder system for forming a gob from a runner of molten glass and delivery means for delivering the gob to the blank station, a mechanism for transferring a parison from the blank station to the blow station and a takeout mechanism for removing a bottle from the blank station,

5 wherein the machine is controlled by a programmable sequencer which defines a 360° machine cycle having a set cycle time,

10 wherein each of the mechanisms is displaced from an advanced position to a retracted position and from the retracted position back to the advanced position during the time of one 360° machine cycle,

15 wherein the duration of displacement of each of the mechanisms from the retracted position to the advanced position and from the advanced position to the retracted position are determinable,

20 wherein interferences exist between the motion paths of the gob, the parison, the bottle and individual mechanisms,

25 wherein the thermal forming of the parison and bottle involve a number of thermal forming processes occurring during the time of one 360° machine cycle and having finite durations,

 wherein process air is supplied for at least one process for a finite duration by turning a supply valve "on" and then "off" during the time of a 360° machine cycle,

 wherein displacements begin and valves are turned "on" and "off" in a desired sequence at discrete event angles around the 360° machine cycle, and

 wherein an unwrapped bottle forming process wherein a gob of molten glass is sheared from a runner of molten glass, the gob is then formed into a

parison in the blank station, the parison is then formed into a bottle in the blow station, and the bottle is then removed from the blow station, takes more than the time of a 360° machine cycle to complete, comprising

unwrapping means for converting the event angles around the
5 wrapped 360° programmable sequencer at which displacements begin and valves
are turned "on" and "off" to event times along an unwrapped bottle forming
process.

2. A machine cycle unwrapper for use with a glass forming machine according to
10 claim 1, wherein the time of an unwrapped bottle forming process is more than
two times the time of a 360° machine cycle.

3. A machine cycle unwrapper for use with a glass forming machine according to
claim 1, wherein said unwrapping means comprise a computerized model of a
15 mathematical representation of a network constraint diagram of the unwrapped
bottle forming process wherein a gob of molten glass is formed from a runner of
molten glass, the gob is then formed into a parison in the blank station, the
parison is then formed into a bottle in the blow station, and the bottle is then
removed from the blow station.

20 4. A machine cycle unwrapper for use with a glass forming machine according to
claim 3, wherein the mathematical representation is a matrix representation.

5. A machine cycle unwrapper for use with a machine which receives an initial
25 product and transforms the initial product into a final product in a plurality of
stations,

wherein the machine is controlled by a programmable sequencer which
defines a 360° machine cycle which has a set machine cycle time,

wherein each of the mechanisms is cycled during the time of one machine cycle,

wherein the duration of each displacement of each of the mechanisms is determinable,

5 wherein the start of each displacement is an event which is selectively actuated in a selected sequence during the time of one cycle of the machine, and

wherein the operation of the machine has a number of constraints including interferences which exist between the motion paths of individual mechanisms, and

10 wherein an unwrapped process wherein the initial product is transformed into the final product takes more than the time of one machine cycle to complete, comprising

unwrapping means for converting the event angles around the wrapped

360° programmable sequencer at which displacements begin to event times

15 along the unwrapped process.

6. A machine cycle unwrapper for use with a machine according to claim 5, wherein said unwrapping means comprise a computerized model of a mathematical representation of a network constraint diagram of the unwrapped

20 process.

7. A machine cycle unwrapper for use with a machine according to claim 6, wherein the mathematical representation is a matrix representation.